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[Bulletins 125 to 137 constitute the Report for 1906. In binding, pages i-viii at the end of this bulletin should be detached and placed before Bulletin 125, which begins with page 1.]

Maine Agricultural Experiment Station

BULLETIN No. 137.

DECEMBER, 1906

CIRCULARS, FINANCES, METEOROLOGY, INDEX.

This bulletin contains circulars published in 1906, the summary of the meteorological observations, the report of the treasurer and the index for the bulletins issued in 1906. Bulletins 125 to 137 make up the Twenty-second Annual Report of the Station.

Requests for bulletins should be addressed to the
AGRICULTURAL EXPERIMENT STATION,
Orono, Maine.

MAINE

AGRICULTURAL EXPERIMENT STATION

ORONO, MAINE.

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NEWSPAPER BULLETINS AND CIRCULARS PUBLISHED IN 1906.

CHAS. D. WOODS.

Whenever there is a matter of importance which we wish to bring promptly to the attention of the people of the State, we make as clear and concise a statement as possible in the style and type of a newspaper column and mail it as a "Special Newspaper Bulletin" to all the press on the Station exchange mailing list. These newspaper bulletins are quite generally printed by the papers, and the Station is under obligations to the press for this opportunity of specially and promptly being put in touch with the people.

The Station also prepares circulars of information which are used in sending to correspondents. During the year the Station has issued several newspaper bulletins on miscellaneous subjects, and has issued quite a number of circulars relative to insects. The subject matter of such of the newspaper bulletins and circulars as has not appeared in the regular bulletins of the Stations is here printed as a matter of permanent record.

POTATO SCAB.

Potato scab is more or less prevalent all over Maine. Because in some years it is more troublesome than in others, and because the disease itself is so little understood by practical growers, there is danger of its not being regarded with the importance that it deserves. For these reasons the Maine Agricultural Experiment Station has prepared the following statements:

The common idea that potato scab is produced by chip dirt, ashes or something of that kind is erroneous. It is a fungus disease and grows from spores, the same as any other fungus. Certain conditions favor its growth and such favorable conditions may be furnished by chip dirt, lime, ashes, etc. When

once introduced into land, no practical way has thus far been found of removing it. How long it will remain in the soil is unknown. It certainly may continue for many years even when no potatoes are grown upon the field.

There are many ways in which it is possible for soil to become affected. The germs may be introduced into the manure pile by feeding scabby potatoes to stock, or by putting them directly into the compost heap. The fungus may then propagate itself in the manure and if this is applied to the land, the disease may be widely disseminated. Alkaline soil favors the growth of the fungus and on this account neither ashes nor lime should ordinarily be used in connection with potato growing. As farm manures are slightly alkaline, they are best not used on potato land. The plowing under of a green crop tends by its fermentation to make the soil slightly acid. This condition is unfavorable to the growth of the fungus. There is a more or less common belief that salt is something of a preventive of potato scab, but exact experiments have failed to demonstrate this.

Probably the most common way in which scab fungus is disseminated is by the use of infected seed. It is therefore of the utmost importance to use clean seed. Where it is impracticable to procure clean seed, or in case of doubt, it should be treated with a fungicide. While such treatment will help scabby seed, it may not act as an entire preventive. It is therefore best not to use seed that is much affected.

Formaldehyde gas either in solution or in the dry gaseous state can be effectively used to clean suspected seed. Formaldehyde (formalin) is sold in a solution of about 40 per cent. strength and can be obtained at any drug store. A few bushels of seed are most conveniently treated as follows: Make up a solution of formalin of the desired bulk, using 16 ounces of formalin (40 per cent. solution of formaldehyde gas) to each 30 gallons of water. Soak the seed two hours in this solution and then spread out the tubers to dry. After drying, the potatoes should be cut and planted in the usual way, but care should be taken not to allow them to touch any box, bag or bin where scabby potatoes have been kept.

The Vermont Experiment Station is studying the treatment of potatoes by formaldehyde gas, and while they have not

reached perfectly definite conclusions, they recommend the following treatment for potatoes in bins.

The bin or room where the potatoes are stored should be closed as tightly as possible. Ten ounces of formalin should be used for every 1,000 cubic feet of room, and the potatoes should be left exposed to this gas for 24 hours. The gas is generated by the action of formalin upon potassium permanganate. For this purpose 3 parts by weight of potassium permanganate are mixed with 8 parts of formalin in an earthen jar. The jar should have a capacity of about a gallon for each pint (16 ounces) formalin. The required amount of permanganate should be placed in the bottom of the jar, and the needed amount of formalin poured over it. The operator should leave the room at once, taking care to close the door as tightly as possible. The retail cost of the chemicals to produce gas for 1,000 cubic feet will be about \$1.50.

For handlers of seed who wish to insure freedom from scab and for large growers of potatoes, this gaseous method is more convenient than the wet method, and experiments at the Vermont Station show it to be effective.

WHITE GRUBS AND JUNE BEETLES.*

The large brown June beetle commonly buzzing and bumping about lights at night, and the larva of this beetle (the white grub) so frequently turned up from the soil by the plow are both too well known to need description. The accompanying figures 24 and 25 illustrate both stages of this insect.

THE JUNE BEETLE. In the spring the fully developed beetles emerge from the ground where they have passed their larval stage. During the day they remain quiet but at night they congregate upon willow, cherry, plum and other trees to devour the leaves. These beetles deposit their eggs usually in grass lands.

* Seven or more closely related species, formerly classed as *Lachnosterna fusca*, are now called the *fusca* group. These with many other species are confused under the name of June beetle, May beetle, or Dorbug, and the larvæ of them all are sufficiently alike to permit them to be classed as one for economical treatment.

THE WHITE GRUB. From the eggs develop the white grubs which spent about 3 years feeding upon the roots of grass and other plants before they attain their full size. When grown they experience a period of rest in the pupal stage while the transformation to the adult beetle takes place.

Although grass roots are the native food of white grubs, a great variety of plants of agricultural value are liable to attack by them,—small grains, Indian corn, potatoes, and beets, to mention a few. Strawberries are especially susceptible and whole beds of these are sometimes destroyed if the plants are set in newly broken or poorly cultivated soil. Young corn meets the same fate if the grubs are thick in the soil. In meadow lands the grubs are often numerous enough to kill the grass over large spaces so that the loose sod can be rolled back like a carpet. It is in places like this that skunks wax fat and sleek, for they tear back the dead sod and eat great numbers of grubs with evident delight.

NATURAL ENEMIES. The white grubs are native insects and are not without natural enemies. Besides skunks which have just been mentioned, moles and ground squirrels eat them. Toads and frogs are fond of the beetles and probably insectivorous snakes deserve to be listed here. Great numbers of birds feed upon either the grubs or the beetles,—among them might be mentioned the robin, catbird, meadow lark, woodpecker, blackbird, crow, owls and hawks.

Fungus parasitism is not uncommon with these beetles and a few insect parasites, dipterous and hymenopterous, have been bred from the white grubs. One of these, the curious *Pelecinus polyturator*, recorded as parasitic upon the white grub by Dr. S. A. Forbes, State Entomologist of Illinois, is given in the accompanying illustration. This queer shaped parasite (Fig. 26) with slender crooked abdomen is common in Maine.

REMEDIES. As these insects pass most of their lives under ground, it is difficult to reach them with insecticides. Bisulphide of carbon, kerosene emulsion and poisoned baits have sometimes been used successfully over small plots but both the cost and the labor involved prohibit the use of the emulsion and bisulphide of carbon over large areas.

Fall plowing, thorough cultivation, and rotation of crops are practical measures. In general any management which

strengthens the plant will lessen losses from insect injury. A rich soil well cultivated may grow crops in spite of an infestation which would be fatal on poorly managed land. Mineral fertilizers such as nitrate of soda, are distasteful to many insects and have some value in this respect as well as in furnishing food for the plants.

Where chickens or turkeys can run through freshly cultivated soil infested by grubs, they prove efficient aids. *Swine are fond of the grubs and where they are pastured on infested land, they doubtless do more than any other means toward freeing the soil of the pests.*

It sometimes happens that the adult beetles are locally so numerous that it is possible and practical to kill them by spraying the trees where they congregate at night, with arsenical sprays. Sometimes, too, they can be jarred from the trees in great numbers and crushed or otherwise disposed of. The jarring is said to be especially effective from 2 to 5 o'clock in the morning when they seem to cling less tightly to the leaves.

Complaints concerning these white grubs have often been sent to this Station during the past 15 years. A report from Bridgton, Me., Sept. 18, 1893, reads in part: "There are many acres of grass land in this town where a good crop of timothy was cut the present season which now show hardly a green blade of grass. These worms (white grubs) are found just below the surface, where they feed upon the roots of timothy."

From Harrison, Me., June 5, 1906, a correspondent writes: "I broke up two acres for sweet corn where the grubs have eaten the grass so it plows like old ground."

These complaints, 13 years apart, are from neighboring towns and yet the correspondent from Harrison says: "I was never troubled with them before."

The grubs become mature in three years and the beetles are not so likely to deposit eggs in places where the infestation has destroyed much of the vegetation as in fresher and more inviting fields.

In conclusion it may be said that though locally and temporarily the white grub is sometimes exceedingly troublesome, there are no indications that in this State they are likely to increase indefinitely or cause excessive damage to any one field for many consecutive years.

RED-HUMPED CATERPILLAR. *ŒDEMASIA* *CONCINNA*.

During August, September and October, the red-humped caterpillar is one of the most troublesome orchard caterpillars in the State. During 1905 more than 80 lots of these caterpillars were sent to the Maine Experiment Station for identification. Many correspondents reported that entire orchards of young trees were stripped of their foliage, except for the mid ribs of the leaves, before the presence of the pest had been discovered.

Life History and Description. The mature insect is an inconspicuous brown moth with wing expanse of slightly more than one inch. The female deposits eggs on the under side of a leaf in a cluster, usually during July. The young caterpillars, which soon hatch from these eggs, feed upon the tender tissues of the under side of the leaf, not attacking at first the upper surface. When they become larger they devour the whole leaf except the mid rib. They move in flocks, an entire brood feeding together and remaining in a cluster when resting. In the caterpillar or larval stage (Fig. 27) this insect is readily recognized. The body of the caterpillar is marked with fine longitudinal stripes of black, white and yellow, and short black spines occur in rows. The head is bright red and the first segment of the abdomen, which is conspicuously humped, is of the same color. The caterpillar in the early stages is not so distinctively marked, however, as the body of the young caterpillar is a dull amber and the head black, the striped markings and the red head not appearing until a later molt. The caterpillars reach their full growth (about $1\frac{1}{4}$ inches) from August to late October. When full grown, they descend to the ground and hide under leaves or other rubbish and make a glassy transparent cocoon, within which they pass their pupal period. They remain in the cocoon all winter and emerge the following season as mature moths.

Remedies. The red-humped caterpillars are not especially difficult to combat if a watch is kept for the colonies while they



Fig 24. June Beetle

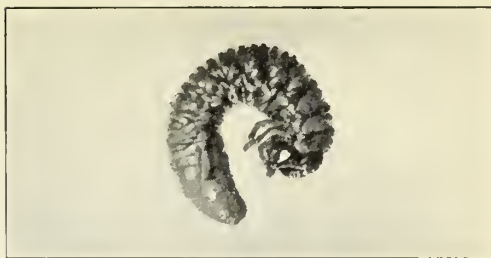


Fig. 25. White grub, larva of June Beetle



Fig. 26. *Pelecinus polyturator* parasite of white grub



Fig. 27. Red-humped caterpillar

are young. As they are gregarious, it is a simple matter to clip off the small twig containing the whole brood of little caterpillars. When they are larger they can often be dislodged by jarring the branch and destroyed on the ground. Arsenical sprays will kill them, but the presence of fruit makes this remedy undesirable for bearing trees late in the season.

THE YELLOW-EDGE OR MOURNING-CLOAK BUTTERFLY.

From Caribou to Kittery the elms in the State are visited by a species of spiny caterpillar which is often present to such an extent as to become a public nuisance.

DESCRIPTION AND HABITS. The adult insect (Fig. 30) is a large butterfly with wings of a rich purplish brown bordered on the upper side by a broad margin of buff. A submarginal band of black is decorated with a row of blue spots. On the under side the wings have a rough brown appearance which renders the butterfly almost impossible of detection when it alights upon the bark of a tree, its favorite resting place. This butterfly thus affords an excellent example of protective coloration. It is called in America the "yellow-edge" butterfly, or almost as commonly by its English name of "mourning-cloak."

Unlike many butterflies, the yellow-edge hibernates over winter in the adult stage and we see this species early in the spring or even in thaw spells during the winter flying about wooded places, or sipping moisture from wet moss and shallow pools. As soon as the leaves start in the spring, the butterfly deposits eggs for the first brood of caterpillars. There are two broods a season and the larvæ or caterpillars are found in Maine from June to late September. They occur most frequently in this State upon the elm, but they also feed upon willow, poplar, and occasionally, though not often, upon apple trees.

The caterpillars (Fig. 28) are formidable looking creatures covered with stiff, sharp spines, the larger of which are branched. The general color is black, flecked with small white dots. The black line which runs along the back is interrupted by eight spots of brick red.

The caterpillars are gregarious and feeding as they do, the whole brood on a branch together, they strip off the leaves thoroughly as they go. Unlike many caterpillars, they do not eat their molted skins and these are frequently seen clinging to a naked branch long after the caterpillars themselves have disappeared.

When full grown, the caterpillars usually migrate from the tree on which they fed to some neighboring shelter. They suspend themselves from the eaves of buildings, edges of clapboards, fence-rails or similar places and there molt for the last time the spiny skin.

The insect now appears in the form of a peculiar ash gray or brownish chrysalis which is sure to excite curiosity the first time it is met with. The shape is much more easily represented by a figure than by a description. When disturbed the chrysalis wriggles violently. Fig. 29.

In about two weeks (usually less with this species), the skin of the chrysalis cracks open and the adult butterfly emerges. The butterflies of the first brood deposit eggs for the next generation at once, but those of the fall brood hibernate in the adult stage and deposit eggs in the spring.

NATURAL ENEMIES. A disease sometimes attacks this insect in the larval stage and a whole brood of limp caterpillars will be found hanging dead to the branch where they had been feeding. A *Tachina* fly is commonly parasitic upon the caterpillar, the full grown maggots dropping from the caterpillars to the ground to pupate, about the time the caterpillars are suspending themselves in preparation for the chrysalis stage. Caterpillars thus attacked, however, die before the chrysalis is formed. A minute hymenopterous parasite deposits eggs in the chrysalis, as many as 89 developing in a single chrysalis.

REMEDIES. In localities where this insect is troublesome, it is well to be on the watch for the caterpillars and remove them while they are yet young. As they are gregarious, the whole brood can be removed easily by clipping the branch on which they are found. Removing the caterpillars by hand is the only remedy needed for small trees and will be sufficient for larger trees in towns supplied with apparatus for removing the winter nests of the brown-tail moths. Where a treatment by poison is desired, arsenical sprays should be thoroughly applied.



Fig. 28 and Fig. 29. Caterpillar and chrysalis of yellow-edge butterfly



Fig. 30 Yellow-edge butterfly



Fig. 31. Elm leaf curl caused by plant lice. *Schizoneura americana*

ELM LEAF-CURL.

A common and widespread enemy to the elm is the plant louse, *Schizoneura americana*, that causes the leaves to curl and present an unsightly appearance. Fig. 31.

The deformed leaf serves as a protection to large colonies of the plant lice, small insects covered with white powder; and contains, besides, the molted skins of the insects and a considerable amount of liquid. The liquid, which is excreted by the plant lice, is called honey dew because it is sweet, and is much sought after by ants who prize it highly as food.

The eggs of this insect live over winter in the crevices of the bark. As soon as the young plant louse hatches in the spring, it crawls out to a tender leaf and settles upon the under side. Here it inserts its beak and sucks the sap for food and the punctured and irritated leaf swells and curls. The individuals of this first generation or stem-mothers are comparatively large and plump plant lice that never acquire wings. They give rise to innumerable progeny that drain the leaf of sap.

The leaves become in consequence badly curled and often those near the tip of the twigs are abnormally clustered into a sickly looking mass or rosette. About the time the leaves become yellowish and unsightly enough to attract attention, a generation of the plant lice is developed which acquire wings and fly from the curled leaves for fresh quarters.

NATURAL ENEMIES. Lady beetles, both in the larval and adult stage, feed greedily upon plant lice and often clear a whole tree of these pests. Striped black and yellowish syrphus flies are commonly seen hovering near to deposit eggs and the maggots which hatch from these are exceedingly rapacious, devouring plant louse after plant louse in quick succession. Predaceous bugs, (*Camptobrochis grandis* and others) are also frequently found feeding upon this species of plant louse.

Besides these predaceous insects, minute internal parasites develop in the bodies of the plant lice, thus destroying great numbers of them.

The ants which attend colonies of plant lice so industriously do not injure them in any way, but are there merely to gather the honey dew.

REMEDIES. Where shade elms are thus affected year after year, watch may be kept for the first signs of deformed leaves early in the season. If these are removed and burned the later numerous generations will not have a chance to develop. As the stem-mothers usually choose a terminal twig on which to start a colony, it is not a difficult matter to keep a young tree comparatively free from leaf-curl. Before the leaves become much curled, kerosene emulsion is an efficient remedy for frequent sprayings early in the season.

As a rule the trouble involved makes either of these measures impracticable when applied to very large trees. There is then nothing to be done except to endure the leaf-curl and leave the plant lice to their natural enemies, who find in the task of extermination both enjoyment and a means of sustenance.

The species of plant louse found in elm leaf-curl does not attack other trees and thus need not be feared as a general pest.

Many other species of plant lice, however, have similar habits, as the ordinary plum aphid, or the snowball aphid, both common in this State. Where any valuable trees and shrubs are attacked year after year by leaf-curling plant lice, the clipping and destruction of the first deformed leaves and early spraying with kerosene emulsion are usually the only available remedies and are often perfectly practical.



Fig. 32 and Fig. 33. Yellow-necked caterpillar and pupa



Fig. 34. *Datana ministra*, adult of yellow-necked caterpillar



Fig. 35. Cecropia caterpillar

YELLOW-NECKED CATERPILLAR. *Datana ministra*.

During the late summer the yellow-necked caterpillar is a common orchard pest in Maine.

LIFE HISTORY AND DESCRIPTION. The moth is tannish brown in color with head and the part of the thorax nearest the head a rich chestnut brown. Several dark brown lines cross the fore wings transversely. The hind wings are pale buff. The female moth deposits about 100 eggs in a cluster on a leaf.

The caterpillars which hatch from these eggs, attain their full growth in five or six weeks. They are then about two inches long. The head is black and the segment just back of the head is orange colored, a character which gives rise to the popular name "yellow-neck." The body is striped longitudinally with alternate yellow and black lines. Soft white hairs occur over the whole body but are too thin to be especially noticeable. Like the red-humped caterpillar, these caterpillars are clustered together both while feeding and when at rest. The caterpillars when at rest assume a characteristic and peculiar position on the branch with both extremities of the body raised. When alarmed they jerk their heads and tails in an irritated manner.

The full grown caterpillars bury themselves in the earth a few inches below the surface, where they transform into brown pupæ, unprotected by any cocoon. They remain in the earth all winter and emerge about the middle of the next summer, when they are transformed to the moth, or mature insect. Moth, larva, and pupa are figured in the accompanying illustrations, Figs. 32, 33, and 34.

REMEDIES. As in the case of the red-humped caterpillar, gathering the caterpillars by hand is the simplest remedy and perhaps the only one which it is necessary to recommend. The caterpillars are gregarious and the whole brood is easily removed from the tree and destroyed. Arsenical sprays will kill them, and may sometimes be a convenient means of combating them.

THE CECROPIA MOTH.

The large gray or brown cocoon of the Cecropia moth is frequently found attached to the twigs of trees. Fig. 36.

These are spun late in August or September by a green caterpillar about four inches long. The body of the caterpillar is ornate with colored bead-like tubercles, the two pairs nearest the head being red with black spines, and the other dorsal tubercles smaller and yellow. Along the sides of the body the tubercles are bluish. Fig. 35.

After the cocoon is spun the caterpillar changes to the pupa, a dark brown object which may be found by opening one of the cocoons during the winter. Fig. 37.

In the spring the insect breaks open the brown pupal skin and emerges from the cocoon as the adult insect, the largest moth in the State and one of the most beautiful. Its expanded wings measure about five and one-half inches. In color the wings are brownish with a border of gray and submarginal lines of white and red. The form of the markings is better represented by the accompanying illustration (Fig. 38) than by a description.

The caterpillar is well attended by insect parasites and is devoured by birds. In this State it has not occurred to a troublesome extent and need not be feared as a pest, although it feeds on apple and various forest trees. No remedies usually seem necessary. If the caterpillars are found upon a small tree which they are likely to injure, hand picking will prove effectual.

Those who find the Cecropia cocoons during the winter are often interested to save them in a warm room for the sake of observing the beautiful moth which emerges.

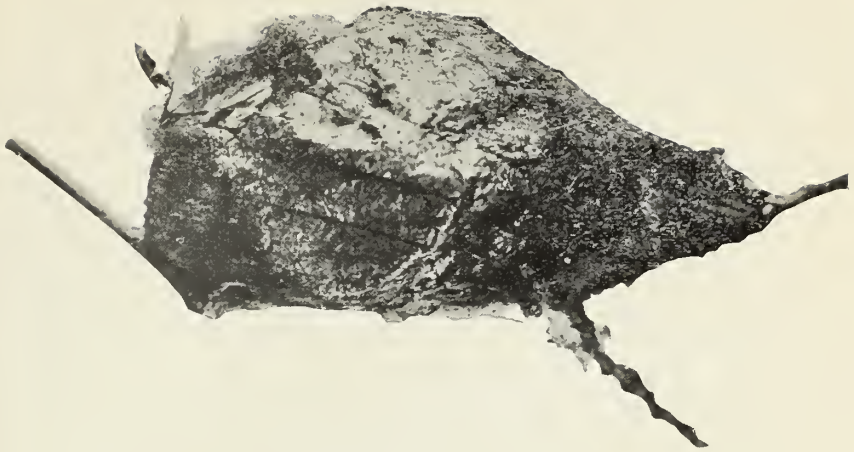


Fig. 36. *Cecropia* cocoon



Fig. 37. *Cecropia* pupa removed from cocoon



Fig. 38. *Cecropia* moth

TENT CATERPILLAR.

Encircling the twig of apple, plum, and wild cherry trees is frequently found a glistening brown mass about three-fourths of an inch in length. Fig. 39.

From such an egg cluster hatch in the spring from 200 to 300 caterpillars, which live in a colony and construct a whitish tent-like web in the angle of two convenient branches. It is in the habit of the tent caterpillars to pass their time when not feeding, particularly at night and during cold or stormy weather, within the tent which they enlarge as their own rapid increase in size calls for more room. During the warm sunny hours of the day they leave their protection and feed voraciously, defoliating the branches in the vicinity of the tents. One colony is enough to denude a young tree or several large branches of an old tree.

The tent which is at first a delicate filmy silken web becomes by the time the caterpillars are full grown a structure two feet or more in length, unsightly with the accumulation of molted skins and other rubbish. Fig. 40.

The full grown caterpillar is nearly two inches long. It is slender, dark, and velvety with numerous soft golden brown hairs upon the body. A white stripe marks the middle of the back, while the sides are streaked irregularly with white or yellow. Along each side of the dorsal white line is a row of transverse pale blue spots.

After feeding for four or five weeks the caterpillars leave the tree in search of a sheltered place for their cocoons, a crevice in the bark, the eaves of buildings, or rubbish piles, proving attractive for this purpose. The cocoon is an elongated oval with the outer silk delicate and loosely woven and the inner part firmer and close. The inner cell is painted on the inside with a thick yellow liquid which soaks through the cocoon and soon dries to a yellow powder. Fig. 41.

The insect remains in the cocoon from two to three weeks, when it emerges as a brown moth expanding about one and one-half inches. The fore wings are crossed obliquely by

two pale lines. The general color of the moth varies from buff to reddish brown in different individuals. Fig. 42.

Natural Enemies. The tent caterpillar is supplied with natural enemies among the birds and parasitic insects. It is susceptible also to attack by bacterial and fungus disease.

Remedies. This insect is so easy to combat that its presence to any great extent in an orchard is due largely to negligence. During the bright days of winter and spring the egg masses are readily detected on young twigs as their varnished surfaces glisten in the sun. These should be removed and burned.

Since the caterpillars congregate in their tents at night and are not early risers, they can be destroyed, the whole colony at once, by soaking the tent with kerosene emulsion, or soap or washing powder suds. This may be applied by a swab attached to a pole. Any time when the whole family is "at home" is suitable for this remedy, as the early morning, evening, or a cold or cloudy day.

Arsenical sprays will kill the caterpillars and may be applied to the branches near the tents. Trees sprayed early in the spring for the bud moth and other early caterpillars will be sufficiently protected against the tent caterpillar also.

TUSSOCK MOTHS.

Among the most constantly appearing orchard pests in the State are the white-marked tussock moth and the antique tussock moth, *Notolophus leucostigma* and *Notolophus antiqua*.

Description and Habits. The conspicuous white egg masses of these moths are deposited late in the summer or in the fall upon the cocoons from which the female moths emerge. As the hairy cocoons are commonly attached to the rough bark, or twigs of the trees the caterpillars infest, the egg-masses are readily found at any time after the leaves have fallen. The eggs which the white-marked tussock deposits are covered with a white frothy substance which becomes brittle upon exposure to the air. Fig. 43. The antique tussock does not protect its eggs in this manner but leaves them uncovered upon the cocoon. Fig. 46.



Fig. 39. Egg-mass of tent caterpillar

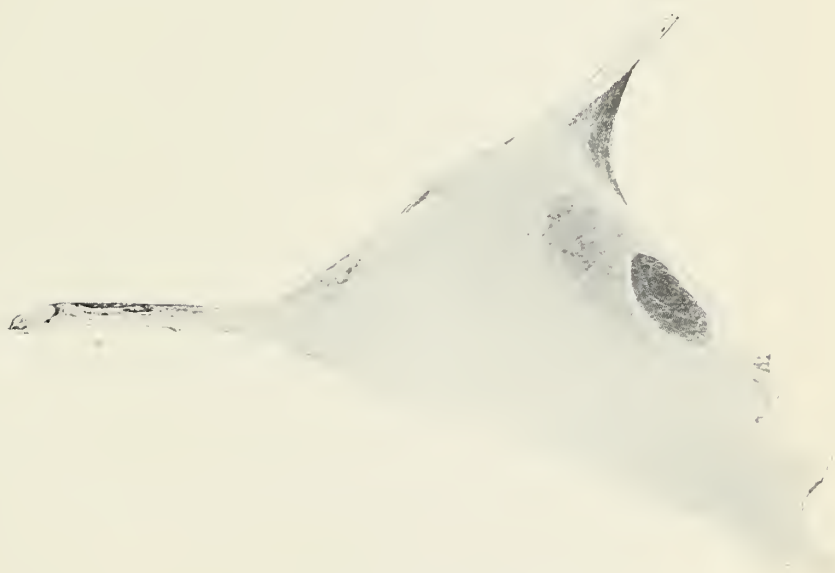


Fig. 40. Tent of tent caterpillar



Fig. 41 and Fig. 42. Cocoon and moth of tent caterpillar

The caterpillars which emerge from these eggs in the spring are most grotesque in appearance. The caterpillar of the white-marked tussock moth when full grown has a shiny coral red head beyond which extend two stiff pencils of black hairs directed forward like horns. A single pencil of similar construction supplies the other end of the body with a tail. Upon the middle of the back, starting a little behind the head, is a row of four regular tufts of soft whitish hairs which resemble small paint brushes neatly trimmed off at the tip. In a line with these but nearer the tail occur two little bright red tubercles. The full grown antique tussock caterpillar resembles closely the species just described. Its head, however, is jet black and it has an additional pair of black pencils, similar to though shorter than the horns, projecting from the sides of the body, which is lacking in the caterpillar of the white-marked tussock. These fantastic little creatures in masquerade attire hold a summer festival upon orchard and shade trees, which often proves to be a serious matter to the owners of the trees.

After feeding for four or five weeks the caterpillar becomes full grown and spins a rough cocoon of silk with which it mixes the hairs that have decorated its body. These cocoons are usually formed upon the bark or in the angles of twigs. Often a leaf is attached to the mass.

In about two weeks the adult insects emerge from the cocoons. Figs. 44 and 45. The males are winged, the white-marked tussock having gray wings which expand nearly one and one-half inches and the antique tussock having smaller brown wings. The female moths of these two species are not readily distinguishable. They never acquire wings and their distended bodies are practically little more than animated sacs of eggs. The females being unable to fly and their bodies being too heavy for their slender legs to drag about, cling to the cocoons from which they emerge and soon after mating deposit about 300 eggs in a mass upon the cocoon. This done they drop to the ground and die without feeding in the adult stage at all.

Natural Enemies. There are several species of parasites, a Tachina fly and an Ichneumon known as *Pimpla inquisitor* prominent among them in this State, which sometimes occur

in such numbers as to murder whole colonies of tussocks in their cocoons. These parasites are however in their turn well attended by parasites so that their aid cannot always be depended upon.

Remedial Measures. A glance over the life history of the tussock moths gives at once a simple and practical means of combating them. The white egg masses deposited on the cocoons remain on the trees all winter. These are readily seen and can be removed and burned. Cocoons of the tussock not covered with eggs should not be disturbed as they are either the empty cocoons of males or cocoons containing parasites. If the cocoons are empty they can do no harm and if they contain parasites, these insect enemies of the tussock should be allowed to develop.

Although the tussocks are two-brooded, this treatment is sufficient, for if the eggs of the winter generation are faithfully removed there will be no parents for the second or summer brood. The fact that the females cannot fly makes this pest easily controlled locally, for the orchardist need not especially fear his neighbor's infested trees.

The caterpillars are susceptible to arsenical sprays and this means of combatting them is sometimes necessary where the winter collecting has been neglected or when the tussocks appear in destructive numbers upon shade trees.

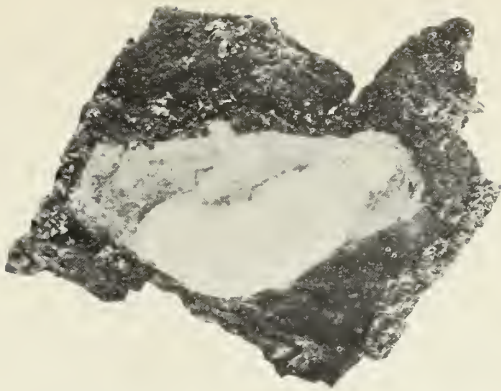


Fig. 43. Froth covered egg-mass of white marked tussock moth on bark



Fig. 44 and Fig. 45. White marked tussock moth. Winged male and wingless female



Fig. 46. Egg cluster and caterpillar of antique tussock moth

METEOROLOGICAL OBSERVATIONS.

Lat. $44^{\circ} 54' 2''$ N. Lon. $68^{\circ} 40' 11''$ W. Elevation 150 feet.

The instruments used at this Station are the same as those used in preceding years, and include: Wet and dry bulb thermometers; maximum and minimum thermometers; rain-gauge; self-recording anemometer, vane, and barometer. The observations at Orono now form an almost unbroken record of thirty-eight years.

In its meteorological aspects every year presents marked characteristics, and the year 1906 was no exception to this rule. The mean temperature for January was the highest ever recorded at this Station for this month, being nearly 10 degrees above the average for the past 38 years. The succeeding month was also warm, though less noticeably so. March, on the other hand, proved the coldest March since that of 1885, and with but three exceptions the coldest ever observed at this Station. The growing season, from June to September inclusive, was warm, and the killing frosts long delayed. These conditions were especially fortunate, since the heavy rains of May greatly delayed planting operations. The summer months were dry and the precipitation for the year was nearly five inches below the average.

METEOROLOGICAL SUMMARY FOR 1906. Observations Made at the Maine Experiment Station.

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Mean.	Total.
Highest barometer.....	30.65	30.83	30.66	30.40	30.23	30.05	30.30	30.28	30.34	30.45	30.17	30.51	30.41	.....
Lowest barometer.....	28.98	29.28	29.65	29.05	29.38	29.39	29.47	29.52	29.20	29.07	29.37	29.21	29.25	...
Mean barometer.....	29.94	30.02	29.85	29.81	29.81	29.80	29.84	29.87	29.92	29.94	29.85	29.93	29.88	.....
Highest temperature.....	52° 0	49° 0	50° 0	64° 0	83° 0	85° 0	87° 0	95° 0	82° 0	73° 0	56° 0	43° 0	.....	.....
Lowest temperature.....	-2° 0	-15° 0	-10° 0	14° 0	28° 0	34° 0	42° 0	39° 0	27° 0	23° 0	5° 0	-21° 0	.....	.....
Mean temperature.....	25° 7	21° 9	23° 4	40° 0	51° 4	63° 1	68° 6	69° 0	59° 2	48° 6	34° 1	17° 0	43° 50	.....
Mean temperature for 38 years.....	16° 1	19° 0	28° 0	40° 7	52° 5	61° 8	67° 0	65° 0	57° 3	45° 0	34° 1	20° 3	42° 23	.....
Total precipitation in inches.....	3.09	2.27	4.34	3.65	5.44	2.86	2.47	1.69	1.51	4.90	3.52	3.37	.....	39.11
Mean precipitation for 38 years.....	4.26	3.84	4.35	2.88	3.54	3.51	3.27	3.50	3.35	3.85	3.72	3.77	.....	43.84
No. of days with precip. of .01 in. or more.....	6	5	9	10	15	10	10	6	9	9	13	12	.....	114
Snow fall in inches.....	6.2	12.5	21.8	11.5	.....	.....	.....	.....	.....	0.5	20.5	24.7	.....	97.7
Average snow fall for 38 years.....	22.6	21.2	16.0	5.3	0.3	.....	.....	.....	.....	0.8	8.3	17.3	.....	91.8
Number of clear days.....	14	11	16	9	9	10	11	20	12	12	6	9	.....	139
Number of fair days.....	5	5	1	5	7	8	9	5	9	5	6	7	.....	72
Number of cloudy days.....	12	12	14	16	15	12	11	6	9	14	18	15	.....	154
Total movement of wind in miles.....	5235	5151	6733	5261	5340	4540	3880	3623	4834	4443	6377	4656	.....	.....

Monthly and Annual Precipitation (as rain) for the Year 1906.

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.
Bar Harbor.....	4.46	2.70	8.10	4.33	4.78	2.25	2.28	0.75	1.40	4.40	4.10	4.55	44.10
Cheesecake.....	2.39	1.61	4.94	.....	.....	.....	.....	0.91	.....	4.32	.....	.....	.....
Cornish.....	2.93	1.76	3.67	1.91	5.14	7.95	5.02	1.92	0.90	4.32	2.57	4.15	42.24
Debsconag.....	.....	2.20	.....	.....	3.53	2.38	3.25	3.16	2.89	7.43	2.87	.....	.....
Eastport.....	3.36	2.30	6.32	3.51	5.63	1.46	1.91	1.79	0.78	3.64	3.56	5.13	39.33
Fairfield.....	2.59	2.52	.....	3.69	3.55	3.29	5.32	4.78	1.55	5.38	2.63	3.55	.....
Farmington.....	2.29	1.89	4.30	2.06	3.67	5.41	6.38	2.42	0.65	4.84	2.94	.....	.....
Fort Fairfield.....	1.86	1.56	2.99	.....	3.38	3.52	.....	.....	.....	.....	.....	.....	40.02
Gardner.....	2.95	1.98	4.80	3.74	4.52	4.89	6.40	1.21	0.94	5.73	3.95	3.41	44.58
Houlton.....	2.70	2.10	3.20	3.20	2.00	1.40	2.55	1.50	1.20	.....	1.20	.....	.....
Lewiston.....	3.15	1.59	4.51	2.93	4.21	7.42	5.44	0.80	0.85	4.97	3.26	3.94	43.07
Madison.....	4.04	2.39	4.83	4.27	5.12	5.72	4.58	2.02	1.09	.....	3.02	5.21	49.03
Mayfield.....	2.69	2.01	5.24	2.70	3.90	4.61	4.66	4.13	2.23	5.54	3.61	3.38	44.61
Millinocket.....	3.09	3.45	6.29	3.69	3.57	.....	3.24	.....	3.16	7.10	4.21	3.35	46.01
North Bridgton.....	2.77	1.52	3.87	2.36	4.05	6.13	5.82	1.79	0.83	5.18	.....	4.32	42.61
Oquossoc.....	2.03	2.04	2.14	2.17	5.67	3.75	4.57	1.33	.....	4.08	1.43	1.90	.....
Orono.....	3.09	2.27	4.34	3.65	5.44	2.86	2.47	1.69	1.51	4.90	3.52	3.97	39.11
Patten.....	1.52	3.80	5.90	2.40	.....	.....	.....	.....	.....	.....	.....	.....	.....
Portland.....	2.87	2.00	4.95	3.53	4.79	7.18	5.95	1.37	1.52	10.10	1.88	2.73	.....
Rumford Falls.....	2.01	1.68	2.79	1.69	.....	5.07	4.32	1.73	0.88	2.75	3.04	4.80	42.54
Thomaston.....	4.74	0.90	5.07	3.64	5.82	.....	6.83	3.47	1.01	4.79	2.68	3.39	.....
Van Buren.....	1.40	1.45	.....	1.60	1.90	.....	.....	.....	.....	6.30	.....	.....	.....
Winslow.....	2.78	1.33	3.33	2.78	4.64	3.28	5.18	2.96	1.16	5.86	2.90	2.24	38.50

With the exception of readings from the Orono station, the above table is compiled from the monthly bulletins of the U. S. Weather Bureau.

REPORT OF THE TREASURER.

Maine Agricultural Experiment Station in account with the United States appropriation, 1905-6, Hatch Fund:

DR.

To receipts from the Treasurer of the United State as per appropriation for the fiscal year ending June 30, 1906, as per act of Congress approved March 2, 1887..... \$15,000 00

CR.

By salaries:

(a) Director and administration officers.....	\$3,948 28
(b) Scientific staff	3,087 58
(c) Assistants to scientific staff.....	475 54
(d) Special and temporary services.....	193 40

Total \$7,704 80

Labor:

(a) Monthly employees	\$931 42
(b) Daily employees	554 13
(d) Teams	75 92

Total 1,561 47

Publications	242 67
Postage and stationery.....	337 77
Freight and express.....	236 64
Heat, light, water, and power.....	592 56
Chemical supplies	135 70

Seeds, plants and sundry supplies:

(a) Agricultural	\$16 49
(b) Horticultural	72 32
(d) Entomological	11 40
(e) Miscellaneous	160 19
(f) Photography	80 31

Total 340 71

Fertilizers	142 85
Feeding stuffs	1,298 85
Library	744 73

Tools, implements and machinery.....	284 49
Furniture and fixtures.....	38 42
Scientific apparatus	510 80
Live stock	44 62
Contingent expenses	21 50
Traveling expenses	449 01
Building and repairs.....	312 41
Total	\$15,000 00

Maine Agricultural Experiment Station in account with the United States appropriation, 1905-6, Adams Fund:

DR.

To receipts from the Treasurer of the United States as per appropriation for the fiscal year ending June 30, 1906, as per act of Congress approved March 16, 1906.....	\$5,000 00
--	------------

CR.

By salaries:

(b) Scientific staff	1,412 50
(c) Assistants to scientific staff.....	212 50

Total \$1,625 00

Labor:

(a) Monthly employees	\$148 97
(b) Daily employees	166 15
(d) Teams	5 30

Total 320 42

Freight and express	70 53
Heat, light, water, and power.....	73 95
Chemical supplies	145 75

Seeds, plants and sundry supplies:

(a) Agricultural	\$33 75
(b) Horticultural	64 88
(d) Entomological	55 93

Total 154 56

Fertilizers	38 68
Feeding stuffs	217 14
Library	427 21
Tools, implements and machinery.....	775 27
Scientific apparatus	870 49
Live stock	31 00
Building and repairs.....	250 00

Total \$5,000 00

I, the undersigned, duly appointed Auditor of the Corporation, do hereby certify that I have examined the books of the Maine Agricultural Experiment Station for the fiscal year ending June 30, 1906, that I have found the same well kept and classified as above, and that the receipts for the year from the Treasurer of the United States are shown to have been \$20,000.00, and the corresponding disbursements, \$20,000.00; for all of which proper vouchers are on file and have been examined by me and found correct.

And I further certify that the expenditures have been solely for the purposes set forth in the acts of Congress approved March 2, 1887, and March 16, 1906.

GEORGE E. FELLOWS, *Auditor.*

Maine Agricultural Experiment Station in account with "General Account" for the year ending June 30, 1906.

DR.

To balance from 1904-1905.....	\$1,108 80	
Sales of produce, inspection fees, etc.....	8,407 36	\$9,516 16

CR.

By salaries	\$2,530 89	
Labor	28 55	
Seeds, plants and sundry supplies.....	18 47	
Feeding stuffs	538 68	
Library	563 72	
Live stock	4 00	
Traveling expenses	269 15	
Buildings	1,876 86	
Balance to 1906-1907 account.....	3,685 84	9,516 16

ISAIAH K. STETSON, *Treasurer.*

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